

RHEOLOGICAL PROPERTIES FROM LATTICE-BOLTZMANN SIMULATION: POSSIBILITIES AND LIMITATIONS

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In this talk, I will outline possible applications of a discrete kinetic theory (the lattice-Boltzmann model) to the simulation of the rheological properties of complex fluids. I will first give a brief summary of work done in our group, applying large-scale lattice-Boltzmann based simulations to the dynamics of settling suspensions. The fundamentals of the method will then be described, followed by a brief outline of some of the test calculations that have been used to validate the method.

Applications of lattice-Boltzmann methods to several classes of complex fluids will then be described, including suspensions, emulsions, non-spherical particles, polymers, and flows in confined geometries. I will describe the modeling of lubrication, inertia, and Brownian motion, and discuss the limitations imposed by resolution and disparate time scales.

Finally, recent improvements to the implementation of the solid-fluid boundary conditions will be outlined, and comparisons with other numerical methods will be made.